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UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)*(Only for new nonprovisional applications under 37 CFR 1.53(b))*Docket No.
NA-1147

Total Pages in this Submission

TO THE ASSISTANT COMMISSIONER FOR PATENTSBox Patent Application
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application as an invention entitled:

COMPARATOR FOR TIME-TEMPERATURE INDICATOR

and invented by:

BRUCE BUTLER WRIGHTIf a **CONTINUATION APPLICATION**, check appropriate box and supply the requisite information:☒ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: 09/057,057

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Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below
2. ☒ Specification having 22 pages and including the following:
 - a. ☒ Descriptive Title of the Invention
 - b. ☐ Cross References to Related Applications (if applicable)
 - c. ☐ Statement Regarding Federally-sponsored Research/Development (if applicable)
 - d. ☐ Reference to Microfiche Appendix (if applicable)
 - e. ☒ Background of the Invention
 - f. ☒ Brief Summary of the Invention
 - g. ☒ Brief Description of the Drawings (if drawings filed)
 - h. ☒ Detailed Description
 - i. ☒ Claim(s) as Classified Below
 - j. ☒ Abstract of the Disclosure

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Application Elements (Continued)

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*

- a. ☐ Formal Number of Sheets _____
- b. ☒ Informal Number of Sheets 1

4. ☒ Oath or Declaration

- a. ☐ Newly executed *(original or copy)* ☐ Unexecuted
- b. ☒ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
- c. ☒ With Power of Attorney ☐ Without Power of Attorney
- d. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application,
see 37 C.F.R. 1.63(d)(2) and 1.33(b).

5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*

The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. ☐ Computer Program in Microfiche *(Appendix)*

7. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*

- a. ☐ Paper Copy
- b. ☐ Computer Readable Copy *(identical to computer copy)*
- c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. ☐ Assignment Papers *(cover sheet & document(s))*

9. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*

10. ☐ English Translation Document *(if applicable)*

11. ☒ Information Disclosure Statement/PTO-1449 ☒ Copies of IDS Citations

12. ☐ Preliminary Amendment

13. ☒ Acknowledgment postcard

14. ☒ Certificate of Mailing

☐ First Class ☒ Express Mail *(Specify Label No.):* EJ470214074 US

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Accompanying Application Parts (Continued)

15. ☐ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*

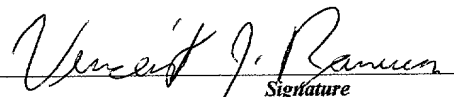
16. ☐ Additional Enclosures *(please identify below):*

Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra	Rate	Fee
Total Claims	20	- 20 =	0	x \$18.00	\$0.00
Indep. Claims	3	- 3 =	0	x \$78.00	\$0.00
Multiple Dependent Claims (check if applicable) <input type="checkbox"/>					\$0.00
BASIC FEE					\$760.00
OTHER FEE <i>(specify purpose)</i>					\$0.00
TOTAL FILING FEE					\$760.00

- ☐ A check in the amount of _____ to cover the filing fee is enclosed.
- ☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. 19-2201 as described below. A duplicate copy of this sheet is enclosed.
- ☒ Charge the amount of \$760.00 as filing fee.
- ☒ Credit any overpayment.
- ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).


Signature


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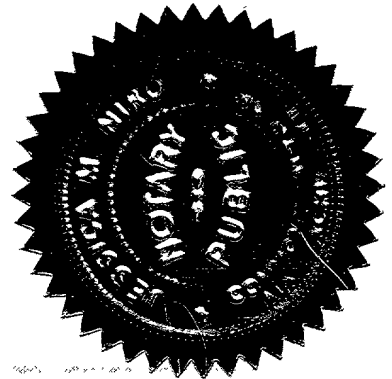
COMMONWEALTH OF MASSACHUSETTS
COUNTY OF MIDDLESEX

I hereby certify that this is a true copy of the prior application, Serial Number 09/057,057 filed on 04/08/98 and entitled, "Comparator for Time-Temperature Indicator" which I have examined this 3RD day of February 1999 at the U.S. Army Soldier and Biological Chemical Command, Natick, MA 01760-5035.



Notary Public
My Commission expires: June 11, 2004

Jessica M. Niro
NOTARY PUBLIC
My commission expires June 11, 2004



COMPARATOR FOR TIME-TEMPERATURE INDICATOR

BACKGROUND OF THE INVENTION

The invention described herein may be manufactured, used and licensed by or for the
5 Government for Governmental purposes without the payment to us of any royalty
thereon.

1. Field Of The Invention

The present invention generally relates to a comparator for use in interpreting data
provided by a time-temperature indicator.

10 2. Problem To Be Solved

Time-temperature indicators ("TTIs") are used for external monitoring of the time-
temperature history of various products such as food. Typically, TTIs are used to monitor
the condition of military-type rations. One such ration is typically referred to as Meal-
Ready-To-Eat ("MRE"). The quality of MRE rations is highly dependent upon the time
15 the MREs spend in storage and the storage temperature.

There are many styles and configurations of TTIs. TTIs are generally described in the
periodical entitled *Food Technology*, October 1991, pages 72-75. TTIs are also generally
described in U.S. Patent Nos. 5,045,283 and 5,057,434. One type of TTI is referred to as
the "bull's eye" style TTI and is configured as a label. The label has an adhesive backing
20 that is adhered to a ration container. The label has a circular-shaped, outer reference
portion and a circular-shaped, active portion within the reference portion. The reference

and active portions are concentrically arranged. In another type of “bull’s eye” style TTI, the reference portion is within the active portion.

The active portion of the “bull’s eye” style TTI changes color over time wherein the rate of change is dependent upon the temperature to which the TTI is exposed.

- 5 Specifically, the rate of darkening of the active portion is dependent upon the storage temperature. Since the quality of the MREs is highly dependent upon the time spent in storage and the storage temperature, the darkening of the active portion can be related to the expiration of the shelf life of the MREs, i.e. degradation in quality of the MREs. The “bull’s eye” type TTIs can be configured to have a predetermined target shelf life.
- 10 Initially, the color of the active portion matches the color of the peripheral or base portion. The target shelf life is attained when the color of the active portion matches the color of the reference portion. One commercially available “bull’s eye” type TTIs is based on a target shelf life of three (3) years at 80°F. Thus, if the “bull’s eye” type TTI is applied to rations that are stored at a temperature of 80°F, the time it takes for the color of
- 15 the active portion to match the color of the reference portion will be about three (3) years. However, if the storage temperature is greater than 80°F, the time it takes for the color of the active portion to match the color of the reference portion will be less than three (3) years. Therefore, the quality of the MRE will be comparable to that of a MRE that was in storage for three (3) years even though it was actually in storage less than three (3) years.
- 20 On the other hand, storing the rations at temperatures below 80°F increases the time

required for the color of the active portion of the TTI to match the color of the reference portion. Thus, the shelf life of the ration is extended beyond three years.

Typically, instrumentation is used to evaluate the change in color of the active portion of the TTI in order to accurately determine the time-temperature condition of the ration to which the TTI is attached. One such instrument is a densitometer. This instrument measures the optical density of both the active portion and the reference portion or the base portion of the "bull's eye" type TTI. However, such instrumentation is expensive. Furthermore, such instrumentation is bulky and inconvenient to carry to the site of the stored rations. What is needed is a lightweight, inexpensive and simple-to-use apparatus for evaluating the color change of the active portion of a TTI label in order to determine the condition of the ration, and hence, the quality of the ration.

It is therefore an object of the present invention to provide an apparatus for evaluating the color change of an active portion of a TTI wherein the apparatus is inexpensive to manufacture.

It is another object of the present invention to provide an apparatus for evaluating the color change of an active portion of a TTI wherein the apparatus is lightweight.

It is a further object of the present invention to provide an apparatus for evaluating the color change of an active portion of a TTI wherein the apparatus is easy to use.

It is yet another object of the present invention to provide an apparatus for evaluating the color change of an active portion of a TTI wherein the apparatus can be conveniently stored when not in use.

Other objects and advantages of the present invention will be apparent to one of ordinary skill in the art in light of the ensuing description of the present invention.

SUMMARY OF THE INVENTION

The present invention is directed to a comparator for use with a time-temperature
5 indicator that has an active portion which has an initial color and which undergoes
chemical changes as time elapses. The rate of chemical change is dependent upon the
temperature of the surrounding environment. The chemical changes produce visual
changes in the color of the active portion of the time-temperature indicator. The
comparator comprises a support member, and a plurality of comparator stages located on
10 the support member. Each comparator stage comprises a first portion that has a reference
color and a second portion that has a predetermined color that is the same as one of the
colors to which the active portion of the time-temperature indicator changes as time
elapses. The colors of the second portions of the comparator stages darken in a
progressive manner such that the predetermined color of the second portion of a first one
15 of the comparator stages is substantially lighter than the reference color of the first stage
and the predetermined color of the second portion of a last one of the comparator stages is
substantially darker than the reference color of the last comparator stage.

The number of TTI comparator stages may be varied depending on the requirements.
In one embodiment, each stage is assigned indicia such as a number. For example, the
20 initial stage can be designated by the number zero (0). Succeeding stages may be

designated with consecutive positive integers. Other identification systems can also be used with the comparator stages, e.g. combinations of letters and numbers.

A user of the comparator of the present invention compares the color of the active portion of a TTI that is attached to a ration or food container (or pouch or other packaging) to the predetermined color of the second portion of each stage of the TTI comparator. The user then selects the comparator stage that has a second portion that has a predetermined color that matches the color of the active portion of the TTI label. If the shade of the color of the active portion of the TTI label is between the shades of the colors of the second portions of adjacent comparator stages, then the user selects the comparator stage that has the second portion with the lighter shade of color. The user then correlates the indicia of the selected TTI comparator stage to a particular condition of the ration.

The TTI comparator of the present invention has numerous advantages in comparison to conventional devices. For example, the TTI comparator of the present invention is relatively simple and inexpensive to manufacture in comparison to instruments such as densitometers. Furthermore, the TTI comparator of the present invention is easy to transport and may be conveniently and easily stored when not in use.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the invention are believed to be novel and the elements characteristic of the invention are set forth with particularity in the appended claims. The figures are for illustration purposes only and are not drawn to scale. The invention itself, however,

both as to organization and method of operation, may best be understood by reference to the detailed description which follows taken in conjunction with the accompanying drawings in which:

FIGS. 1-3 illustrates a "bull's eye" type TTI wherein an active portion of the TTI is undergoing changes in color.

FIG. 4 is a plan view of the TTI comparator of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

In describing the preferred embodiments of the present invention, reference will be made herein to Figs. 1-4 of the drawings in which like numerals refer to like features of the invention.

Although the ensuing description is in terms of how the comparator of the present invention is used with the TTI having the configuration shown in Figs. 1-3, it is to be understood that the comparator of the present invention, shown in Fig. 4, may be used with TTIs having other types of configurations.

Fig. 1 shows time-temperature indicator ("TTI") 10 which has a "bull's eye" configuration. TTI 10 is configured as a label that can be attached to food or ration containers. TTI 10 comprises a base region 12, a reference portion 14 and an active portion 16. Reference portion 14 and active portion 16 are circular in shape and are concentrically arranged as shown in Fig. 1. Base region 12 has a fixed color. Reference portion 14 has a fixed color which is substantially darker in shade than the color of base region 12. The active portion 16 initially has a color that is the same as base region 12.

In one type of TTI, active portion 16 is comprised of a monomer. As the monomer polymerizes, it darkens as time elapses and darkens more rapidly as the temperature increases. A red-colored film is typically disposed over TTI 10 to block ultraviolet (UV) light.

5 Fig. 1 shows active portion 16 having an initial color that is the same as that of base region 12. As time elapses, the color of active portion 16 darkens. This is represented by active portion 16' shown in Fig. 2 wherein the shade of the color of active portion 16' is lighter than that of reference portion 14. Fig. 3 shows TTI 10 wherein the color of the active portion has further darkened. As shown in Fig. 3, the shade of the color of the
10 active portion is darker than the reference portion 14. This condition is represented by active portion 16''.

Fig. 4 shows the TTI comparator 18 of the present invention. Comparator 18 comprises support member 19 and a plurality of comparator stages 20, 22, 24, 26, 28 and 30 attached to the support member 19. Although the ensuing description is in terms of
15 comparator 18 having six (6) stages, it is to be understood that the comparator 18 may utilize less than or more than six (6) stages. In one embodiment, each comparator stage 20, 22, 24, 26, 28 and 30 may be realized as a label having an adhesive backing that is applied to support member 19. In another embodiment, each comparator stage is printed on support member 19. In a preferred embodiment, support member 19 is substantially
20 flat and is fabricated from lightweight materials such as paper, cardboard, plastic, wood, etc. Other suitable materials may also be used.

Referring to Fig. 4, stage 20 comprises base portion 32, reference portion 34 and test portion 36. Stage 22 comprises base portion 38, reference portion 40 and test portion 42. Stage 24 comprises base portion 44, reference portion 46 and test portion 48. Stage 26 comprises base portion 50, reference portion 52 and test portion 54. Stage 28 comprises base portion 56, reference portion 58 and test portion 60. Stage 30 comprises base portion 62, reference portion 64 and test portion 66. As shown in Fig. 4, the shade of the color of the test portions 36, 42, 48, 54, 60 and 66 darken progressively from left to right. As a result of such a configuration, each test portion has a predetermined color that is the same as one of the colors to which active portion 16 of TTI 10 changes as time elapses, changing more rapidly with an increase in temperature. The color of each reference portion of each comparator does not change and therefore functions as a reference.

Referring to Fig. 4, the reference and test portions may be arranged, with respect to another, in any one of a variety of arrangements and may be configured to have any type of geometric shapes, e.g. square, rectangular, triangular, etc. For example, as shown in Fig. 4, the reference and test portions of the stages are shown to be substantially circular in shape and concentrically arranged wherein the diameter of the reference portion is greater than the diameter of the test portion. However, Fig. 4 illustrates just one example and it is to be understood that other configurations may be implemented. For example, the reference and test portions may be configured such that the reference and test portions are substantially circular in shape and are concentrically arranged with the reference portion being located within the perimeter of the test portion. In another example, the

reference and test portions may be realized by strips adjacent to one another. As previously stated, many other configurations are possible. Similarly, although the base region of each comparison stage is shown in Fig. 4 to have a square shape, each base region may be configured to have other shapes. Furthermore, each comparator stage may
 5 be configured without a base region.

Each comparator stage has indicia (not shown) associated therewith to enable the user to identify a particular stage. The indicia of each stage is assigned a particular time-temperature condition, e.g. excellent, good, poor, etc. This will be explained in detail later.

10 Referring to Fig. 4, in a preferred embodiment, the color of the base region of each stage 20, 22, 24, 26, 28 and 30 is substantially the same as base region 12 of TTI 10, and the reference portion of each stage 20, 22, 24, 26, 28 and 30 is substantially the same as that of reference portion 14 of TTI 10. It is also highly preferable that the color of test portion 36 of stage 20 (which is the first stage) is substantially the same as the color of
 15 the initial color of active portion 16 of TTI 10. The initial color of the active portion 16 is the color of portion 16 when first applied to the ration at the beginning of its shelf life.

Referring to Figs. 1-4, in order to determine the time-temperature condition of a ration or food product, the user holds support member 19 adjacent to TTI 10 and compares the color of active portion 16 TTI 10 to the predetermined color of the test portion of each
 20 stage 20, 22, 24, 26, 28 and 30. The user then selects the comparator stage that has the test portion having the color that matches the color of active portion 16. If the shade of

the color of active portion 16 is between the shades of the colors of the test portions of two adjacent comparator stages, the user selects the comparator stage having the test portion with the lighter shade of color. The user then correlates the indicia of the selected comparator stage to a particular time-temperature condition. In one embodiment, this can be accomplished by using a chart or "look-up" table that contains the indicia of each comparator stage and the corresponding time-temperature condition. In another embodiment, the user inputs the indicia of the selected comparator stage into a microprocessor, personal computer or laptop (hereinafter collectively referred to as "computer"). The computer comprises a memory having stored therein a chart, table or array containing the indicia of all the comparator stages and the corresponding time-temperature conditions. Upon entry of the indicia of the selected comparator stage, the computer outputs the corresponding time-temperature condition. The hand-held chart or table, described above, or the computer, may be configured to also provide additional information or instructions as to what steps should be taken regarding the rations, e.g. consume immediately, dispose, maintain in storage, etc.

Another advantage of comparator 18 of the present invention is that the time-temperature condition of the ration may also be determined when the shade of the color of the active portion of the TTI 10 falls between the shades of the colors of the test portions of two adjacent comparator stages. As described above, if such a condition does occur, the user selects the comparator stage having the test portion with the lighter shade of color. Furthermore, if the color of the active portion of the TTI is darker than the color

of the test portion 66 of last comparator stage 30 (see Fig. 4), then the user selects stage 30 and uses the indicia associated with that stage to determine the time-temperature condition of the ration. Thus, comparator 18 allows for the determination of time-temperature condition for at least twelve (12) different shades of color of the active portion of a TTI.

Table I further illustrates how comparator 18 of the present invention can be used to determine the time-temperature condition of rations. For purposes of explaining how comparator 18 is used to determine time-temperature conditions, comparator stages 20, 22, 24, 26, 28 and 30 have been assigned numerical indicia 0-5, respectively, wherein "0" designates a first or initial comparator stage. As mentioned above, such indicia may be located adjacent the appropriate comparator stage. The information listed under the heading "Elapsed Time At 80°F" is based on a TTI that is configured to have a target shelf life of three (3) years at a temperature of 80°F. (Such a configuration has been previously discussed). It is to be understood that Table I may contain information relative to TTIs that are configured to have different target shelf lives at different temperatures. Furthermore, it is to be understood that the format of Table I and the information presented therein is for purposes of facilitating understanding of the invention and constitutes only one example. Other suitable formats may also be used.

TABLE I

	<u>Selected Stage</u>	<u>Elapsed Time At 80°F</u>	<u>Ration Quality</u>
	0	6 months	Excellent
	1	1 year	Excellent
5	2	2 years	Good
	3	3 years	Good
	4	3½ years	Poor
	5	4 years	Very Poor

10 Table I may be realized as a printed table that can be hand carried, or it may be stored in the memory of a computer. The following examples, taken in conjunction with Figs. 1-4 and Table I, will further illustrate the workings and advantages of comparator 18 of the present invention.

Example 1

15 It is desired to determine the quality of a ration having TTI 10 attached thereto. The active portion of TTI 10 has a color represented by active portion 16 shown in Fig. 1. The user compares the color of active portion 16 to the predetermined color of the test portion of each stage 20, 22, 24, 26, 28 and 30. The user determines that the color of the active portion 16 matches the color of the test portion 36 of stage 20. As described

20 above, stage 20 has been assigned numerical indicia "0". The user then locates indicia "0" in Table I (or inputs "0" into the computer) under the heading "Selected Stage" and then observes the corresponding information, e.g. Elapsed Time At 80°F and Ration

Quality, in the row corresponding to "0". As shown in Table I, the corresponding Elapsed Time At 80°F is about six (6) months and the Ration Quality is excellent.

Example 2

It is desired to determine the quality of a ration having TTI 10 attached thereto. The active portion of TTI 10 has a color represented by active portion 16' shown in Fig. 2. The user compares the color of active portion 16' to the color of the test portion of each stage 20, 22, 24, 26, 28 and 30. The user determines that the color of the active portion 16' matches the color of test portion 42 of stage 22. As described above, stage 22 has been assigned numerical indicia "1". The user then locates indicia "1" in Table I (or inputs "1" into the computer) under the heading "Selected Stage" and then observes the corresponding information, e.g. Elapsed Time At 80°F and Ration Quality, in the row corresponding to "1". As shown in Table I, the corresponding Elapsed Time At 80°F is one (1) year and the Ration Quality is excellent.

Example 3

It is desired to determine the quality of a ration having TTI 10 attached thereto. The active portion of TTI 10 has a color represented by active portion 16'' shown in Fig. 3. The user compares the color of active portion 16'' to the color of the test portion of each stage 20, 22, 24, 26, 28 and 30. The user determines that the color of the active portion 16'' matches the color of test portion 60 of stage 28. As described above, stage 28 has been assigned numerical indicia "4". The user then locates indicia "4" in Table I (or inputs "4" into the computer) under the heading "Selected Stage" and then observes the

corresponding information, e.g. Elapsed Time At 80°F and Ration Quality, in the row corresponding to “4”. As shown in Table I, the corresponding Elapsed Time At 80°F is three and one-half (3½) years and the Ration Quality is poor.

Thus, TTI comparator 18 of the present invention achieves the objects set forth above.

5 Specifically, TTI comparator 18 is:

- a) lightweight;
- b) easy and convenient to transport;
- c) easy to store when not in use;
- d) easy to use; and
- 10 e) inexpensive to manufacture.

While the present invention has been particularly described, in conjunction with a specific preferred embodiment, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art in light of the foregoing description. It is therefore contemplated that the appended claims will embrace any such alternatives, modifications and variations as falling within the true scope and spirit of the present invention.

15

Thus, having described the invention, what is claimed is:

CLAIMS

1. A comparator for use with a time-temperature indicator, the time-temperature indicator having an active portion having an initial color and which undergoes chemical changes as time elapses and at a rate related to the temperature of the surrounding environment wherein the chemical changes produce changes in the color of the active portion, the comparator comprising:

a support member; and

a plurality of comparator stages located on the support member, each comparator stage comprising a first portion having a reference color and a second portion having a predetermined color that is the same as one of the colors to which the active portion of the time-temperature indicator changes, the colors of the second portions of the comparator stages darkening in a progressive manner such that the predetermined color of the second portion of a first one of the comparator stages is substantially lighter than the reference color of the first stage and the predetermined color of the second portion of a last one of the comparator stages is substantially darker than the reference color of the last comparator stage.

2. The comparator according to claim 1 further comprising indicia formed on the support member to facilitate identification of each stage.

1 3. The comparator according to claim 1 wherein the first portion and second portion are
2 adjacent to each other.

3

1 4. The comparator according to claim 1 wherein the first portion is located within the
2 perimeter of the second portion.

3

1 5. The comparator according to claim 1 wherein the second portion is located within the
2 perimeter of the first portion.

3

1 6. The comparator according to claim 1 wherein the first and second portions are
2 substantially circular in shape, the first portion having a diameter greater than the
3 diameter of the second portion, the first and second portions being concentrically
4 arranged.

5

1 7. The comparator according to claim 1 wherein each comparator stage further includes a
2 base region surrounding the first and second portions.

3

1 8. The comparator according to claim 7 wherein each base region has a substantially
2 square shape.

3

1 9. The comparator according to claim 7 wherein each base region has a color that is the
2 same as the color of the second portion of the first comparator stage.
3

1 10. The comparator according to claim 1 wherein the support member is substantially
2 planar.
3

1 11. The comparator according to claim 1 wherein the support member is fabricated
2 from cardboard.
3

1 12. The comparator according to claim 1 wherein each of the comparator stages is
2 attached to the support member.
3

1 13. The comparator according to claim 1 wherein each of the comparator stages is
2 printed on the support member.
3

1 14. The comparator according to claim 1 wherein each of the comparator stages
2 comprises a label having an adhesive backing, each of the comparator stages being
3 adhered to the support member.
4

1 15. The comparator according to claim 1 wherein the plurality of comparator stages
2 comprises six (6) comparator stages.

3
1 16. A comparator for use with a time-temperature indicator, the time-temperature
2 indicator having an active portion having an initial color and which undergoes chemical
3 changes as time elapses and at a rate related to the temperature of the surrounding
4 environment wherein the chemical changes produce changes in the color of the active
5 portion, the comparator comprising:

6 a substantially planar support member; and

7 a plurality of comparator stages printed on the support member, each comparator
8 stage comprising a first portion having a reference color and a second portion
9 having a predetermined color that is the same as one of the colors to which the
10 active portion of the time-temperature indicator changes, the first and second
11 portions being substantially circular shaped, the second portion having a diameter
12 that is less than the diameter of the first portion, the first and second portions
13 being concentrically arranged, the colors of the second portions of the comparator
14 stages darkening in a progressive manner such that the predetermined color of the
15 second portion of a first one of the comparator stages is substantially lighter than
16 the reference color of the first stage and the predetermined color of the second
17 portion of a last one of the comparator stages is substantially darker than the
18 reference color of the last comparator stage; and

19 whereby a user of the comparator compares the color of the active portion of the time-
20 temperature indicator to each comparator stage to determine if the color of the
21 active portion is the same as the color of the second portion of any of the
22 comparator stages.

23

1 17. A method of determining the time-temperature condition of a food product having
2 applied thereto a time-temperature indicator, the indicator having an active portion having
3 an initial color and which undergoes chemical changes as time elapses and at a rate
4 related to the temperature of the surrounding environment wherein the chemical changes
5 produces changes in the color of the active portion, the method comprising the steps of:

6 (a) providing a comparator comprising support member, and a plurality of
7 comparator stages located on the support member, each comparator stage
8 comprising a first portion having a reference color and a second portion having a
9 predetermined color that is the same as one of the colors to which the active
10 portion of the time-temperature indicator changes, the colors of the second
11 portions of the comparator stages darkening in a progressive manner such that the
12 predetermined color of the second portion of a first one of the comparator stages
13 is substantially lighter than the reference color of the first stage and the
14 predetermined color of the second portion of a last one of the comparator stages is
15 substantially darker than the reference portion of the last comparator stage;

- 16 (b) comparing the color of the active portion of the time-temperature indicator to the
17 predetermined color of the second portion of each comparator stage;
- 18 (c) selecting the comparator stage having the second portion with the predetermined
19 color that matches the color of the active portion of the time-temperature
20 indicator; and
- 21 (d) correlating the comparator stage selected in step (c) to a particular time-
22 temperature condition.

23

- 1 18. The method of claim 17 wherein selecting step (c) further comprises the steps of:
2 determining if the shade of the color of the active portion of the time-temperature
3 indicator is between the shades of the colors of the second portions of adjacent
4 comparator stages; and
5 selecting from the pair of adjacent comparator stages the stage having the second
6 portion with the lighter shade of color if it is determined that the shade of the
7 color of the active portion of the time-temperature indicator is between the shades
8 of the colors of the second portions of adjacent comparator stages.

9

- 1 19. The method according to claim 17 wherein the comparator further includes indicia
2 located adjacent to each comparator stage to facilitate identification of each comparator
3 stage, the selecting step (c) comprised of the step of selecting the indicia that identifies

6

20. The method according to claim 19 wherein correlating step (d) further comprises the step of correlating the indicia of the selected comparator stage to a particular time-temperature condition.

ABSTRACT

A comparator for use with a time-temperature indicator wherein the time-temperature indicator includes an active portion having an initial color and which undergoes chemical changes as time elapses and at a rate related to the temperature of the surrounding environment and wherein the chemical changes produce changes in the color of the active portion. The comparator comprises a substantially planar support member, and a plurality of comparator stages located on the support member. Each comparator stage comprises a first portion having a reference color and a second portion having a predetermined color that is the same as one of the colors to which the active portion of the time-temperature indicator changes. The predetermined colors of the second portions of the comparator stages darken in a progressive manner such that the predetermined color of the second portion of a first one of the comparator stages is substantially lighter than the reference color of the first stage and the predetermined color of the second portion of a last one of the comparator stages is substantially darker than the reference color of the last comparator stage. A user of the comparator compares the color of the active portion of the time-temperature indicator to each comparator stage to determine if the color of the active portion is the same as the predetermined color of the second portion of any of the comparator stages.

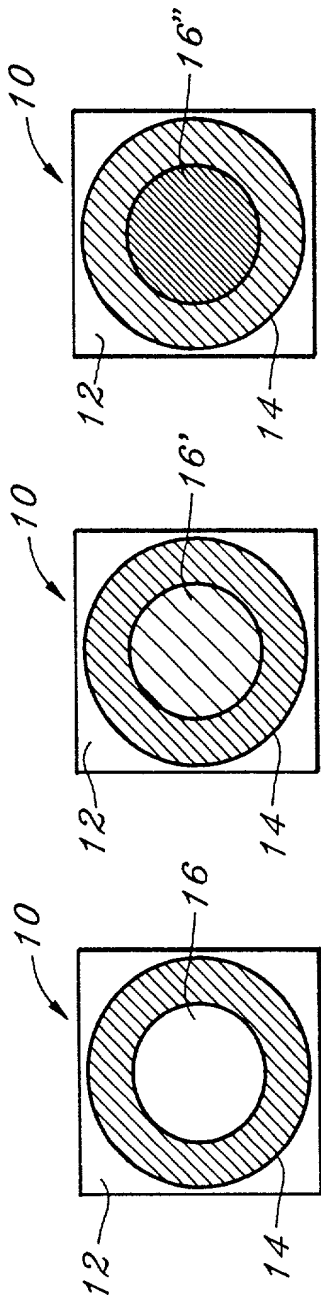


Fig. 1

Fig. 2

Fig. 3

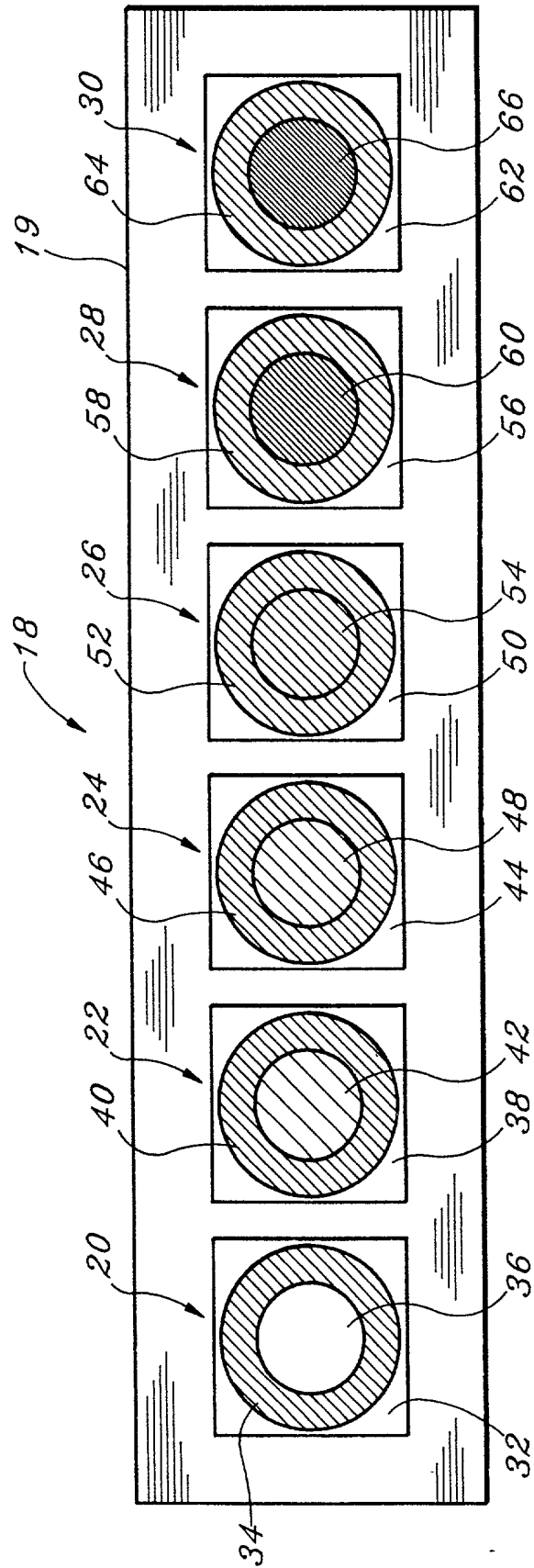


Fig. 4

Docket No.
NA-1147

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

COMPARATOR FOR TIME-TEMPERATURE INDICATOR

the specification of which

(check one)

☒ is attached hereto.

☐ was filed on _____ as United States Application No. or PCT International Application Number _____ and was amended on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Priority Not Claimed

(Number)

(Country)

(Day/Month/Year Filed)

☐

(Number)

(Country)

(Day/Month/Year Filed)

☐

(Number)

(Country)

(Day/Month/Year Filed)

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I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

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(Filing Date)

(Application Serial No.)

(Filing Date)

(Application Serial No.)

(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

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(Filing Date)

(Status)
(patented, pending, abandoned)

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

(Application Serial No.)

(Filing Date)

(Status)
(patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

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